Lesson Plan: Bacterial Conjugation
Grades 6-8 (can include 5th)
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Supplies

- Yarn tied in large loop (or paper
- Food
- Scissors
- Colored rubber bands
- Scotch tape

Goals

- Students understand the basic concept of bacterial conjugation.
- Students know that DNA is a 'code' for all living things, and that a plasmid is DNA.
- Students understand that bacteria
    1) are alive,
    2) have DNA,
    3) can gain or transfer genes (or abilities)
- Students will begin to think more deeply what sort of uses it can have both inside and out of the lab.

Introduction:

Pass out colored rubber bands. Make sure each student has one. Tell them to hang on to it.
To draw interest initially, the teacher will draw an analogy between Iron Man and bacteria. Iron Man's power comes from his suits, which, when switched out or modified, can change his abilities. Bacteria, like every other living organism, has DNA. Bacteria can gain new 'powers' by modifying their genes.

Show picture of Iron Man. Ask if anyone knows who this is. Where does he get his powers from?

His suit.

Show picture of bacteria. Ask if anyone knows what it is. If needed, explain that this is bacteria and describe briefly. Ask how bacteria is similar to Iron Man. s

Ask kids what DNA is. (DNA is a code that tells cells what to do. Every living thing has DNA.) Like Iron man and his suit, bacteria can easily 'switch out' pieces of their DNA. This gives them 'super powers' that they could never otherwise have. Some bacteria can glow, some can withstand extreme temperatures, some can break down pollution.

Elaboration/Activity

Show diagram of plasmid. Explain that it's circular. Explain that bacterial genome is also circular. Ask kids what they think: how can the bacteria gain the 'powers' inside the plasmid?

Ask for four volunteers. Give out: pair of scissors, large loop of yarn, roll of scotch tape.

- Scissors: restriction enzyme
- Yarn: Native Bacterial DNA
- Tape: Sticky ends
- Fourth student is the pilus.

Ask these students to imagine that they are inside a bacteria cell. All the other kids in the audience are other bacteria who have plasmids—the rubber bands. Ask the audience to stand up and just kind of wander around holding their plasmids. The pilus student can take up whatever plasmid that passes by. (For the purposes of the demonstration, the four students should not move and can only take one plasmid at a time.) Once plasmid is chosen, ask everyone but the first four students to sit down.

Now, ask these students to try and get the new DNA to be part of the 'native DNA.' If prompting is needed, provide it. Once they've figured it out, tell the four that the gene they added in won't turn them into Iron Man… but it so happens to allow that bacteria to eat certain types of food… follow this with some sort of snack prize. Send these students back to their seats.

Tell the rest of the students that since they are also bacteria, and they all have these special genes, they are also able to eat the special food too. Have each color of rubber band correspond to a different type of snack. Pass around food.

Conclusion

If time permits, open up discussion regarding potential applications for bacteria's ability to add in new genes. The end goal is to have them thinking about some of the major tools of synthetic biology. Remember to prompt questions whenever possible!
When students are eating, quiz them with a jeopardy game that reviews some of the things they just learned. Some of the more challenging questions will address applications in synthetic biology.